hardware elements, via tangibly embodied software executing on a processor, or via combination of both. A program of computer-readable instructions may be embodied on a computer readable memory such as for example any of the MEMs detailed below with respect to FIG. **8**.

[0087] If desired, the different functions discussed herein may be performed in a different order and/or concurrently with each other. Furthermore, if desired, one or more of the above-described functions may be optional or may be combined.

[0088] Reference is now made to FIG. **8** for illustrating a simplified block diagram of various electronic devices and apparatus that are suitable for use in practicing the exemplary embodiments of this invention. In FIG. **8**, a wireless network **1** is adapted for communication over a wireless link **11** with apparatus, such as a mobile communication device which may be referred to as a UE **10**, via a network access node, such as an eNodeB **14** for the case of an LTE or LTE-A network. Each of the UEs **10** (one illustrated at FIG. **8**) communicates using a wireless link **11** with the eNodeB **14**. For the UE(s) for which the eNodeB **14** does not have valid CSI the link **11** is MIMO with spatial diversity. The wireless network **1** may include a network control element (NCE) **16** that may implement mobility management entity (MME) and/or serving gateway (S-GW) functionality such as that known in the LTE system, and which provides connectivity with a further network, such as a publicly switched telephone network and/or a data communications network (e.g., the Internet).

[0089] The UE **10** includes a controller, such as a computer or a data processor (DP) **10**A, a computer-readable memory (MEM) **10**B that tangibly stores a program of computer instructions (PROG) **10**C, and at least one suitable radio frequency (RF) transmitter and receiver (shown together as **10**D) for bidirectional wireless communications with the eNodeB **14** via one or more antennas **10**E (one shown). The UE **10** may also have functionality to demodulate the distributed control channel/E-PDCCH that it receives over the wireless link **11** using the DMRSs that correspond to the precoding vectors used by the eNodeB **14** to precode its E-PDCCH as detailed by example above.

[0090] The eNodeB **14** also includes a controller, such as a computer or a data processor (DP) **14**A, a computer-readable memory (MEM) **14**B that tangibly stores a program of computer instructions (PROG) **14**C, and at least one suitable RF transmitter and receiver shown together as **14**D) for communication with the UE **10** via one or more antennas **14**E (two shown, but as with the above examples there may be four or even an antenna array of more than four). The eNodeB **14** has functionality to implement the localized and distributed precoding vector selection as detailed in the examples at FIGS. **3-6** and the summary at FIG. **7**. The eNodeB **14** is additionally coupled via a data/control path **13** to the NCE **16**. The NCE **16** also includes a controller, such as a computer or a data processor (DP) **16**A and a computer-readable memory (MEM) **16**B that stores a program of computer instructions (PROG) **16**C. The NCE **16** may be connected to additional networks such as the Internet. The path **13** may be implemented as the Si interface known for the LTE system. The eNodeB **14** may also be coupled to another eNodeB (or Node B) via data/control path **15**, which may be implemented as the X2 interface known in the LTE system.

[0091] The techniques herein may be considered as being implemented solely as computer program code embodied in a memory resident within the UE **10** or eNodeB **14** (e.g., as PROG **10**C or **14**C, respectively), or as a combination of embodied computer program code (executed by one or more processors) and various hardware, including memory locations, data processors, buffers, interfaces and the like, or entirely in hardware (such as in a very large scale integrated circuit). Additionally, the transmitters and receivers **10**D and **14**D may also be implemented using any type of wireless communications interface suitable to the local technical environment, for example, they may be implemented using individual transmitters, receivers, transceivers or a combination of such components.

[0092] In general, the various embodiments of the UE **10** can include, but are not limited to, cellular telephones, personal digital assistants (PDAs) having wireless communication capabilities, portable computers having wireless communication capabilities, image capture devices such as digital cameras having wireless communication capabilities, gaming devices having wireless communication capabilities, music storage and playback appliances having wireless communication capabilities, Internet appliances permitting wireless Internet access and browsing, as well as portable units or terminals that incorporate combinations of such functions.

[0093] The computer readable MEMs **10**B and **14**B may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, flash memory, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The DPs **10**A and **14**A may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on a multi-core processor architecture, as non-limiting examples.

[0094] Although various aspects of the invention are set out in the independent claims, other aspects of the invention comprise other combinations of features from the described embodiments and/or the dependent claims with the features of the independent claims, and not solely the combinations explicitly set out in the claims.

[0095] It is also noted herein that while the above describes example embodiments of the invention, these descriptions should not be viewed in a limiting sense. Rather, there are several variations and modifications which may be made without departing from the scope of the present invention as defined in the appended claims.

1-29. (canceled)

30. A method comprising:

providing antenna port sharing among N antenna ports used for localized control channels and M antenna ports used for distributed control channels by selecting a first precoding vector based on channel state information (CSI) related to a user equipment (UE);

mapping a first control channel precoded with the first precoding vector for the UE to a localized evolved or enhanced control channel element (E-CCE);

assigning the first control channel to a first antenna port selected from the set of antenna ports used for localized control channels;

selecting the first antenna port and the first precoding vector for a second control channel;

selecting a second antenna port from the set of antenna ports used for distributed control channels for the second control channel;